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[54] Invention: Optical Scanner

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Specifications

1. Name of the invention

Optical Scanner

2. The Scope of the Claim

The invention has the following features:

The invention is equipped with multiple units of barcode readers and has an ability to prioritize. It is placed in the pathway of the goods and each barcode reader optically reads the barcode information on the products.

After reading the barcode information, the above-mentioned barcode reader sends a "may the read data be outputted?" request to the also above-mentioned prioritizing unit. The barcode reader has this special ability; it outputs the read data only after it receives the "

read data may be outputted" permission signal which in turn is outputted in answer to the above-mentioned "may the read data be outputted?" request.

The above-mentioned prioritizing unit's key process: it sends the "read data may be outputted" permission signal only to the ONE barcode reading unit that FIRST sent the "may the read date be outputted?" request signal.

3. The Description of the Workings of the Unit

[Applications in Industry]

The invention can be used in supermarkets or other mass-selling stores where the barcodes can be read optically and the read data can be used by an electronic cash register or a unit that processes information by a POS modem.

[The customary technology that has been used so far]

Hitherto, a stationary scanning unit that reads the optically encoded barcodes on the goods, is attached to the electronic cash register or to the POS modem. The scanner sends data and the cash register or the POS modem processes the information.

The problem with this setup is that the operator has to find where the barcode is on the goods and then orient the goods one by one so that the barcode faces the scanner as the operator moves the products down the line.

[The Problem that the Invention is Trying to Address]

With the customary bar code reading setup, since there is only one scanner, the reading range is limited to the scanning ability of one scanner. Normally, since the reading range is determined by the reflecting angle of the laser beam, the scanning pattern, and the strength of the reflected beam, it is very hard to make improvements when there is only one scanner.

Thus, the following problems arise. First, the probability that the barcode can be read with one scanning procedure is low. Second, as mentioned above, the operator has to first check where the barcode is on the product, orient each product in its unique position so that the barcode faces the window of the scanner and then move the product down the line. Thus, there was unnecessary stress on the operator and on the whole, the process was not very efficient.

Now, the goal of this invention was to solve these problems. By expanding the reading range of the scanning unit, it was easier on the operator by relieving some of the cumbersomeness mentioned above, and at the same time, it provided a unit where the probability that the code would be correctly spotted and read on the first scan was greatly enhanced.

[The Way the Invention Solved the Problems]

Thus, this invention has multiple barcode reading units aligned with the pathway of the goods so that the scanning range is enlarged. The invention is also equipped with a prioritizing system where if more than two scanning units read off data, the data is prioritized in the order that they were read off. To go through the prioritizing procedure, after reading the barcode information, the barcode reader sends a "may the read data be outputted?" request to the prioritizing unit. The barcode reader needs the " read data may be outputted" permission signal to output the read data. Now this answering " read data may be outputted" permission signal from the prioritizing system is sent only to the FIRST barcode reader that sent the "may the read date be outputted?" request signal.

[The Operation]

If one or more of the barcode readers reads-off the barcode encoded on the product, that barcode reader that read the data outputs a "may the read data be outputted?" request. Under the prioritizing system, the "read data may be outputted" permission signal is sent only to the first barcode reader that sent the request. Then, the barcode reader that received permission signal, outputs the read-off data.

Therefore, since many barcode readers are scanning instead of one, the scanning range is greatly enhanced. The operator would not have to pay as much attention to whether the barcode is facing the scanning window accurately and the probability that the barcode is read on the first try is improved as well.

[The Execution of the Invention]

Using the diagrams that follow, the workings of the invention are explained below.

In diagram 1, the layout of the whole invention is shown. This example invention unit is comprised of three barcode readers 11 [1], 11[2], and 11[3], that read optically encoded barcodes on the products, a POS modem that processes the data D1, D2, and D3, which are the read-off data from 11 [1], 11[2], and 11[3], respectively, and the priority determining circuit 41 which sends out the "output-request-accepted" signal, either ACK1, ACK2, or ACK3 in response to the first sent output permission request signal, REQ1, REQ2, or REQ3, which are sent by the above-mentioned barcode readers 11 [1], 11[2], and 11[3].

The three barcode readers 11 [1], 11[2], and 11[3], as shown in diagram two, are arranged so that each barcode reading window 14 faces the product as it moves along the line. Barcode reader 11[1] is placed horizontally, barcode reader 11[2] vertically, barcode reader 11 [3] diagonally and the three sandwich the route.

Each barcode reader is setup as it is in diagram 3. In the diagram, the laser from the lastertube 12 is emitted out of the barcode reading window 14 after it is reflected off the rotating mirror of the laser-collecting component 13. Now, after the laser beam is reflected off the product's barcode 15, the beam is collected by the laser-collecting component 13 and detected the reflecting beam detector 16. This signal is amplified by the amplifying circuit 17 and then it is converted into digital signals by the A/D converter circuit 18. After this, the signal is inputted into the CPU 19.

The CPU 19 is connected to a ROM 20, a RAM 21, and a timer 22. Following the program in the ROM 20, the CPU 19 starts up the motor 24 via the motor driving circuit 23. At the same time, the CPU 19 stores the data it obtained from the A/D converter circuit 18 into the RAM 21 and also checks that the data check digits are correct. If the check digits are not correct, the data is discarded. If they are correct, the output permission request signals, REQ1, REQ2, and REQ3 are allowed into the prioritizing circuit 41. Then, after the "output-request-accepted" signal (either ACK1, ACK2, or ACK3) which is emitted in response to the request signals, is received, the read data is transmitted into the POS modem 31 via the communication interface 25. Also, if the "output-request-accepted" signal (either ACK1, ACK2, or ACK3) is not received within a set time limit T1 which is timed by the timer 22 after the output permission request signals, REQ1, REQ2, and REQ3, have been sent, the output permission request signals (REQ) are withdrawn. It should be noted here that most of this procedure described above is driven mainly by the CPU19 and the ROM 20.

The POS modem is able to process the read data, D1, D2, and D3, which are outputted by the barcode readers 11 [1], 11[2], and 11[3], by a pre-determined process. It is also able to send the data to a host computer that does not show the processed data in a graphic form.

As diagram 4 illustrates, the prioritizing circuit 41 is comprised of the following three units. Circuit 42 receives output permission request signals, REQ1, REQ2, and REQ3 from the barcode readers 11 [1], 11[2], and 11[3]. The timer 43, driven by the above-mentioned circuit 42, makes the enable signal EN go "L" for the set time T2. The controller 44 sends out the "output-request-accepted" signal (either ACK1, ACK2, or ACK3) to the first output permission request signals, REQ1, REQ2, or REQ3 while the above-mentioned enable signal EN is "H" (i.e. when the data output connection is enabled.)

Next, the actual execution of the invention is outlined.

Let the product move in the direction of the arrow in diagram 2. After one or more of the barcode readers 11 [1], 11[2], and 11[3], reads the barcode 15 on the product, the barcode readers each check the read barcode 15 for the correct check digit. If the check digit is correct, the output permission request signals, REQ1, REQ2, and REQ3 are outputted into the prioritizing circuit 41. While the enable signal EN is "H", the prioritizing circuit 41 accepts output permission request signals, REQ1, REQ2, and REQ3 from the barcode readers 11 [1], 11[2], and 11[3] and consequently sends out answering "output-request-accepted" signal (either ACK1, ACK2, or ACK3) to the barcode reader, either 11 [1], 11[2], or 11[3], which sent out the first output permission request signal. In other words, since the timer 43 is turned on by the first request signal and the enable signal EN is set to "L" by this for a set time T2, the other request signals that might come after the first are not received and answered to.

For example, as illustrated in diagram 5, in the case where the output permission request signal REQ2 from the barcode reader 11 [2] is the first one emitted, followed by output permission request REQ1 and REQ3 from the barcode readers 11[1] and 11[3], the controller 44 answers to REQ2 and emits "output-request-accepted" signal, ACK 2 to the barcode reader 11[2].

Then, the barcode reader 11[2], with the condition that it receives the permissive signal, ACK 2, from the controller 44, sends the read data D2 to the POS modem 31 via the communication interface 25.

While the above is going on with the barcode reader 11[2], barcode readers 11[1] and 11[3] emit output permission request signals REQ1 and REQ3 for the time T1 set by the timer 22. If the permissive signal, ACK 1 or ACK3 is not received within this time limit, the read data temporarily stored in the RAM 21 is flushed.

Therefore, according to the procedure outlined above, since three barcode readers 11 [1], 11[2], and 11[3], face the product line instead of one, the scanning range is enlarged. Also, the operator would not have to pay as much attention to whether the barcode is facing the scanning window accurately and the probability that the barcode is read on the first try is improved as well.

Plus, this system has the two following properties set up. Each output permission request signals, REQ1, REQ2, and REQ3 from the respective barcode readers 11 [1], 11[2], and 11[3] are emitted after one or more of them reads off barcode data, and "output-request-accepted" signals (ACK1, ACK2, and ACK3) answering to the permission request signals, are needed for the read data, D1, D2, and D3, to be read into the POS modem 31. The

system has another function set up. In the prioritizing circuit 41, "output-request-accepted" signals (ACK1, ACK2, and ACK3) are sent out only to the barcode reader, 11 [1], 11[2], or 11[3], which sent out the first output permission request signal, REQ1, REQ2, or REQ3 and thus the invention is able to allow only one set of read data to be effective for one reading sequence.

Also, during the state where the enable signal EN is "H", in other words, when it is in its data-transaction permissible state, since the controller 44 in the prioritizing circuit 41 does not accept and answer to output permission request signals, REQ1, REQ2, and REQ3 after receiving the first output permission request signal, REQ1, REQ2, or REQ3, for a certain time period T2, the inefficient mistake of having two readings by the same barcode reader, either 11 [1], 11[2], or 11[3], can be avoided.

In the example outlined above, there are three barcode reading units but there may be two or even more than four. For a setup with two barcode reading units, they could be arranged in the fashion illustrated in diagram 6. Barcode reader 11[1] could be set horizontally, and the other barcode reader 11[2] could be set vertically. Both barcode readers can be set vertically as illustrated in diagram 7 as well. Even more, both barcode readers ca be set horizontally as well as illustrated in diagram 8.

Also in the example outlined above, the prioritizing circuit 41, the POS modem 31, and each barcode reader 11[1], 11[2], and 11[3], are set up as separate units but the prioritizing circuit 41 can be built into one of the barcode readers, either 11 [1], 11[2], or 11[3], or it can be setup in the internals of the POS modem 31. This way, the CPU 19 of one of the barcode readers, either 11 [1], 11[2], or 11[3], or the CPU of the POS modem 31 can be used for the prioritizing circuit 41.

Also, in the example outlined above, the read data from the first barcode reader, either 11 [1], 11[2], or 11[3], was set up to be processed in the POS modem 31 but a device like the electronic cash register may be used to process the data. In other words, a cash registering system like the POS modem of the electronic cash register, should be used to process the read data.

[The Efficacy of the Invention]

As outline above, with this invention, multiple units of barcode readers can be used to read off the barcodes and it is designed so that only the first read data is outputted. Thus, the reading range, compared to a scanner with only one barcode reader, can be greatly enlarged. So, the operator would not have to pay as much attention to whether the barcode is facing the scanning window accurately and thus reducing the burden on him, and the probability that the barcode is read on the first try is improved as well.

4. A simple Explanation of the Diagrams

Diagrams 1 to 5 illustrate one example that uses this invention. Diagram one is a block diagram illustrating the whole architecture, diagram 2 is a cross section of the setup of the three barcode readers, diagram 3 is a block diagram showing the circuitry of the barcode reader, diagram 4 is a circuit diagram illustrating the prioritizing circuit 41, and diagram 5 is a timing chart explaining the manipulation of the prioritizing circuit 41. Diagrams 6 to 8 depict different configurations of a setup with two barcode reading units in cross section diagrams.